Representing Multiple Reaches in a Single Watershed

Q: How can I represent more than one RF1 or RF3 stream segment within a watershed? How are runoff and pollutant loads from the land area within a single subwatershed distributed over multiple stream segments?

A: Running NPSM from the BASINS GIS interface extracts stream reach information (Reach File, V1 or Reach File, V3) for each subwatershed. As shown in Figure 1, only data for the downstream-most reach in a headwater subwatershed is extracted into the NPSM stream network. Information for multiple reaches is extracted for mainstem stream segments within nonheadwater subwatersheds. For example, stream segments D and F are included in the stream network for Subwatershed 003.

Stream flow is routed though each of the represented stream segments. Therefore, stream network and characteristic data, including stream geometry for creating F-tables, are needed for each of the represented stream segments. This data is extracted from the Reach File as described in Table 1. Reach File, V3 does not include all the required data. The user should use field measurements for stream cross-section data when available.

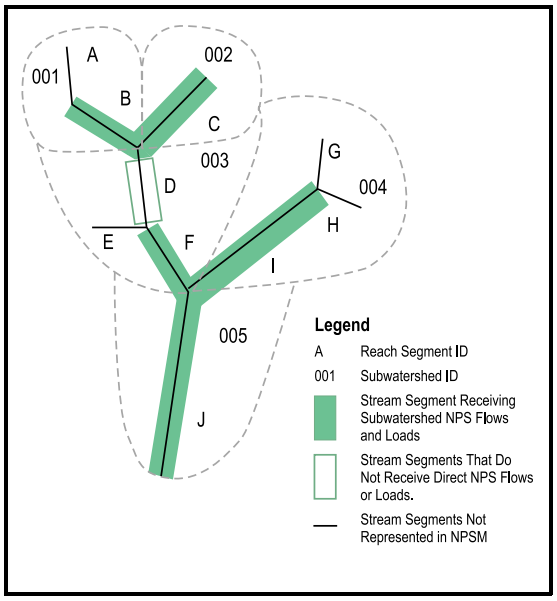

Figure 1

Runoff from pervious or impervious land segments within a given subwatershed becomes an input to the downstream-most reach only. For example, in Figure 1, runoff from Subwatershed 003 will be routed into reach F only. Reach D will receive stream flows and loads from upstream reaches but not runoff from Subwatershed 003. NPSM is not currently setup to distribute runoff and water quality constituents to multiple reaches within a single subwatershed. However, there are two options for changing how runoff is distributed to multiple stream reaches as described below:

1. **Delineate all intermediary subwatersheds:** Prior to running NPSM, subwatersheds can be delineated for each stream segment in the network. Creating a subwatershed for reach D will distribute the runoff from the original Subwatershed 003 to both reach D and F (Figure 2). Use the identify tool in the BASINS GIS to identify individual reach segments. This option is particularly useful when modeling RF1 segments. However, for large study areas or for modeling RF3 segments it may not be practical or desirable to create a subwatershed for each stream segment.

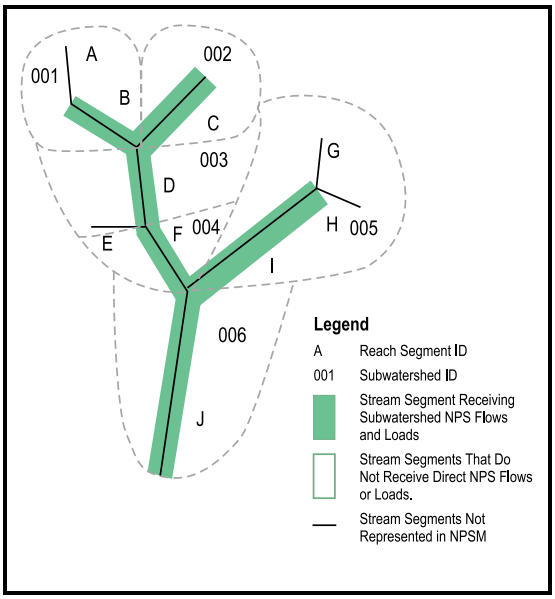

Figure 2

2. **Combine intermediary reaches into a single segment:** Multiple stream reaches can be represented as a single reach by changing the reach network and stream characteristics in the NPSM Reach Editor. This option will route flow and load contributions from the land through the entire length of the stream within the subwatershed (Figure 3).

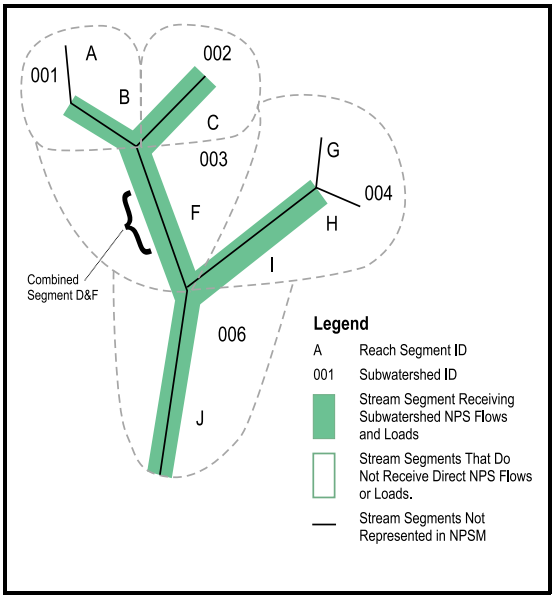

Figure 3

Procedure:

a. Select Add/Remove Reaches from the NPSM Reach Editor menu. For the selected subwatershed, delete the extra stream segments so there is only one stream segment represented in the subwatershed. Note that the subwatershed containing each stream segment is identified in the last field labeled "watershed".

b. From the Setup Reach Network or Reach Network Visualization screens, update the stream network to incorporate the changes.

c. Update the stream length (miles), deltaH, and elevation in the Reach Characteristics screen. The length will be the sum of lengths for the multiple stream segments within the subwatershed.

d. Update F-Tables parameters (refer to Section 10.4 of the BASINS User Manual):
   i. From the F-Table screen select Import/Export. Import the project PTF file from the \\BASINS\MODELOUT\"Project Name" directory.
   ii. Update the length field (feet) for the selected reach and select OK.
   iii. Update stream cross-section data in the F-Table or Cross Section screens as needed.

e. The reach information is now updated . Proceed with model setup and run NPSM.

Table 1. Stream reach data extracted from Reach Files for NPSM.

Reach Characteristics for RCH file	RF1 Field Name	RF3 Field Name	Description
Reach ID	Rivrch	rf3rchid	
Reach Name	Pname	Pname	Feat_name for Pacific NW
# of Exits	K	Divergence	
Type (Stream/Lake)	Type	ReachType	
Watershed-ID	None	None	NPSM assigned
Headwater Flag	Type	ReachType	
Upstream segment left	Ulcsm	Ulrf3rchid	
Upstream segment right	Urcsm	Urrf3rchid	
Complementary segment	Ccsm	Curf3rchid	
Downstream segment	Dscsm	Dsrf3rchid	
Segment Length	Segl	Segl or length	
Delt h	Pbotele, Ptopele	None	
Elevation	Pbotele, Ptopele, Pslope	None	
Mile point	Milept	Mi	Rmi for Pacific NW
Stream Level	Lev	Level	
F-Table Information for PTF file	**RF1 Field Name**	**RF3 Field Name**	**Description**
Reach Number	Rivrch	Rf3rchid	
Length, L (ft)	Segl	Segl or Length	Segl in miles, Length in meters
Mean Depth, Ym (ft)	Pdepth	None	
Mean Width, Wm (ft)	Pwidth	None	
Mannings Roughness Coeff., N	Pmann	None	
Long. Slope, S (ft/ft)	Pslope	None	
Type of x-section	None	None	Default = Trapezoid
Side slope of upper floodplain, m31, m32 (ft/ft)	None	None	Default = 0.5
Side slope of lower floodplain, m21, m22 (ft/ft)	None	None	Default = 0.5
Side slope of channel, m11, m12 (ft/ft)	None	None	Default = 1
Floodplain width, W11, W12 (ft)	None	None	for Rf1, Set to Wm
Channel Depth, Yc (ft)	None	None	for Rf1, Yc = Ym X 1.5, Yc = Ym for lakes
Floodplain side slope changes at depth, Yt1 (ft)	None	None	for Rf1, Yt1 = Yc X 1.5, Yt1 = Ym for lakes
Maximum Depth, Yt2 (ft)	None	None	for Rf1, Yt2 = Yt1 X 100
No. of exits	K	Divergence	
Fraction of flow through exit 1	None	None	1
Fraction of flow through exit 2	None	None	Not available
Fraction of flow through exit 3	None	None	Not available
Fraction of flow through exit 4	None	None	Not available
Fraction of flow through exit 5	None	None	Not available